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Risk Arbitrage in the Nordics

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Abstract

This paper examines the existence of risk arbitrage in the Nordic market. The study includes 182 public cash offers from 2007 to 2016, and three differently weighted risk arbitrage portfolios consisting of Norwegian, Swedish, Danish and Finnish transactions. The risk arbitrage investment strategy is benchmarked with the CAPM, Fama-French Three-factor with and without a liquidity factor. When benchmarked on the European market returns, the value-weighted risk arbitrage portfolio generates annual excess returns of 6%, the equal-weighted generates 12% and the practitioner arbitrage portfolio 4%. However, when benchmarked on the Nordic market index, the portfolios do not generate excess returns. Contrary to most of the previous research on risk arbitrage, these results lead to the conclusion that there are no excess returns in Nordic risk arbitrage.

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1. Introduction

Mergers and acquisition (M&A) activity among listed companies often affect their stock prices dramatically. When investors hear rumours of a forthcoming bid on a target company, the acquisition target's stock price usually shoots for the sky. An illustrative case is the rumours of a possible bid on the airliner Norwegian, which on the 12th of April 2018 sent the stock price up 45% in a matter of hours. The possible acquirer, IAG, later confirmed the rumour and the stock price kept climbing upwards in the following days. The IAG share dropped about 1% in the same time span (Baigorri and Nair 2018). It is a dream come true for the lucky pre-rumour investors earning a 47% return in half a day. But what about the investors buying shares in the target after the rumour is confirmed? Is there any profit left for them?

When a bid materializes, there is usually a spread between the stock market price and the offered price. In a risk arbitrage investment strategy, arbitrageurs try to profit from this spread by taking different positions in the target and acquirer stock. This study aims to examine the risk and returns associated with risk arbitrage in the Nordic market. I first identify 182 Nordic public tender cash offers starting March 2007 and ending in December 2016. I construct three differently weighted passive risk arbitrage portfolios consisting of long-positions in the target companies' shares. The three portfolios are: one value-weighted, one equal-weighted and one practitioner arbitrage portfolio where any active deal is restricted to maximum 10% of the total portfolio. In addition to the portfolios of the combined Nordic markets, I construct portfolios partitioned by country. I then use the CAPM and the Fama-French Three-factor model with and without a liquidity factor to assess the existence of abnormal returns. Furthermore, I perform risk arbitrage benchmarks on both Nordic and European market returns, as well as Norwegian and European factors. It is important to note that I consider the benchmark on the Nordic market the most important and precise analysis of excess returns in the Nordic markets. The European benchmark is performed for comparison purposes.

The existence of excess returns in risk arbitrage investment strategies has been proven in several previous studies. Interestingly, my contribution contrasts most previous research; I find no excess returns when benchmarking the Nordic risk arbitrage portfolios on the Nordic market, meaning that there are no abnormal returns for Nordic risk arbitrageurs. In addition, the risk arbitrage portfolios all exhibit market neutral risk characteristics. When benchmarked on the European market, the value-weighted portfolio generates monthly excess returns of

0.5%, the equal-weighted 1% and the practitioner arbitrage portfolio about 0.35%. Compared to the U.S., Mitchell and Pulvino (2001) find monthly excess returns in the range of 0.3%-0.74%, while Baker and Savasoglu (2002) find monthly excess returns between 0.6% and 0.9%. Overall, the U.S. results are very similar to the Nordic risk arbitrage portfolios benchmarked on the European market, but in stark contrast to the general conclusion of no excess returns in Nordic risk arbitrage. In Germany, the results are similar to the Nordic risk arbitrage portfolios, and the German market are arguably more similar to the Nordic markets. McDermott and Mulcahy (2017) find near zero excess return for their equal-weighted portfolio, and no excess returns for either value-weighted or constrained practitioner portfolio.

This study is divided into five main sections. Following the introduction, I will give a more detailed description of risk arbitrage and the risk associated with the investment strategy. I will also review previous literature and compare it to this study. In section 3, I present the data collection process as well as the construction and description of the Nordic risk arbitrage portfolios. Section 4 presents the empirical analysis and results, for both the combined Nordic and the country specific risk arbitrage portfolios. In section 5, the last section, I summarize and conclude the study.

2. Risk arbitrage and previous research

2.1 Risk arbitrage

Risk arbitrage, sometimes called merger arbitrage, is an investment strategy where investors speculate in stock prices associated with upcoming or ongoing mergers and acquisition events. In a normal merger or acquisition, the acquiring company will offer a price above the current market rate for the target company's shares. In such a situation, an arbitrage opportunity arises. According to Bodie, Kane, and Marcus (2014), a strict definition of arbitrage is simultaneously buying and selling the same asset for a profit without risk. The looser industry definition is referred to as *risk arbitrage*; opportunities where securities are mispriced in specific areas (e.g. merger-target stocks). An *arbitrageur* is an investor specializing in these deals, searching for mispriced financial instruments and commodities in a market or between several markets.

Thus, the possible profit in a risk arbitrage investment is the spread between current market price and future price offered by the acquiring entity, the *arbitrage spread*. A deal valued at EUR 10 per share but currently trading at EUR 9 per share exhibits an arbitrage spread of 10%. Isolated, the arbitrageur stand to profit 10% on his investment. As the deal nears completion, the arbitrage spread is reduced to zero when the market and offer price converges on the completion date. Additionally, the arbitrage spread indicates the level of uncertainty, where a small spread indicates a positive likelihood for deal completion and vice versa. Deal completion is the main condition for profit; if the deal fails, the target share price is likely to lose the value gained during the deal process. A study by Davidson, Dutia, and Cheng (1989) on 163 failed mergers concludes that both deals cancelled by acquirers and deals cancelled by targets causes target share prices to revert back to pre-merger value. Depending on when the arbitrageur made the investment, the losses can be catastrophic.

As with many financial endeavours, the sooner the investors execute their strategy, the larger the potential profit, but also the risk. The potential upside is often bigger if the arbitrageur execute the investment strategy on a rumour, before an actual bid. However, if the offer never materializes, there is only downside. Professional arbitrageurs consider the risk of failure (withdrawn bids or cancelled mergers) carefully before executing a risk arbitrage strategy. The notion that the risk arbitrage strategies are mostly performed by professional

investors is backed by Shleifer and Vishny (1997), who notes that these arbitrageurs are few, specialized, skilled professionals who invest other people's money.

2.1.1 Transaction types in M&A

The risk arbitrage investment strategies depends on the deal type in the merger or acquisition. There are three main deal types; cash deals, stock deals and mixed deals. The deal type is synonymous with the type of payment offered.

In a cash deal, the acquirer offers the target shareholders a specified cash amount per share. The main reasons for cash offers are typically that the target has a substantial lower market value than the acquirer does, or that the acquirer have large cash reserves. The risk arbitrage investment strategy is simple; the arbitrageur buy the target stock and collects the bid price when (if) the deal is completed. The effective return will be the arbitrage spread at the time of investment.

Stock deals involves a payment in the acquirer company's stock. The number of stocks is set to either a fixed ratio (e.g. 1 acquirer stock for 1 target stock) or a fixed monetary value (e.g. EUR 2 worth of acquirer stocks for 1 target stock). Fixed ratio stock deals are by far the most widespread in use. Boone, Lie, and Liu (2014) finds that only about 4% of stock deals have a fixed monetary value. The risk arbitrage investment involves going long in the target company stock, and short selling the acquiring company stock. When the deal is completed, the arbitrageur receive stocks in the acquiring company that is used to cover the short position. The arbitrage spread at the time of strategy execution determines the profit, and it is thus a "fixed" return; only a deal failure can disrupt the return.

Cash and stock deals have more or less straightforward conditions which make them ideal for risk arbitrage. Deals with a mix of stocks and cash, however, are more complicated and involves more steps. In addition, there may be options, earn-outs and other more complex financial instruments complicating the execution of a risk arbitrage investment strategy. In a study of U.S. deals, Boone, Lie, and Liu (2014), found that mixed deals amounted to 30% of all deals between 2001 and 2013. In the same period, stock deals amounted to under 20% of all deals, a decline in popularity from earlier periods. They also found that cash offers are the preferred bid method in the period, amounting to over 50% of all deals.

2.1.2 Deal-specific risk in M&A

Since the risk arbitrage investment strategy is, in essence, dependent on the price movement of stocks involved in M&A, the risk associated with it is largely deal-specific. The possibility of deal failure arises from both internal and external issues, but three of the main sources are; target shareholders, the bidding company and regulatory compliance.

First, in some instances, the shareholders may be reluctant to accept a bid, even with a premium, because they believe the shares are worth more than the market price. In such instances, there are often recommendations from the board to refuse a bid, and it is considered a hostile takeover if the bidding company wishes to proceed without recommendation. In the Nordic countries, the shareholder ownership concentration is often larger than in the U.S. and U.K. (Moschier and Campa 2009), making it more difficult to perform hostile takeovers. In a study on the European merger industry Moschier and Campa (2009) find that the Nordic countries yield on average the lowest premiums in Europe. They note that lower premiums may be a result of a higher likelihood for friendly deals.

Second, the bidding company needs to sell their takeover plans to their own shareholders. If the shareholders find the plans lacking or unprofitable, they might stop a forthcoming deal. There are also the issue of funding. A transaction usually take months, or even years to complete. The terms of funding may change during the period due to changes in both the bidding company and capital markets. In public tender offers, the bidding company usually set a rate of approval required for the takeover to commence. If they only get acceptance for 85% of the shares but the conditional bid required a 90% acceptance rate, the bidding company might withdraw their bid.

Third, regulatory compliance issues are often the biggest headache. Even if two parties are ready to merge, with both funding and shareholder approval in place, they are dependent on governmental approval. In cross-border M&A there are usually several national and trans-national authorities involved in the approval process. Such governing bodies might be competitive authorities, environmental regulators or even national approval for foreign ownership. This is illustrated by the acquisition talks between the German company Bayer and the U.S. company Monsanto in 2017. Both the European Commission and the U.S. Justice Department expressed antitrust concerns and demanded divestments from Bayer. In April, 2018, after Bayer presented a divestment plan, both the European Commission and the U.S.

Justice Department approved the transaction. And naturally, the share price went up and the arbitrage spread narrowed (Reuters 2018b, 2018a).

2.2 Previous research

Numerous studies have been conducted on the return associated with risk arbitrage as an investment strategy as well as the risk and return characteristics of such a portfolio. As far as I know, there are no previous studies exploring the topic in the combined Nordic market. Most of the previous literature is focused on U.S. mergers and acquisitions, and thus offer results for a market, legislation and business culture that differ somewhat from what we find in the Nordic region. Contrary to this study, The U.S. research reviewed generally concludes that there are abnormal returns in risk arbitrage investment strategies. Earlier research typically focused on event-time in risk arbitrage, looking at averaged returns from events and annualizing them. In one such study, Bhagat, Brickley, and Loewenstein (1987) examines 295 cash tender offers in a period spanning from July 1962 to December 1980. They benchmark the target stock in the tender period to both the target stock before the offer, and after the expiration of the offer. In average, they find excess returns of about 2%. In a similar study, reported by Karolyi and Shannon (1999), Dukes, Frohlich, and Ma (1992) find average excess returns of about 24.6% in an average holding period of 52.4 days. It would mean an annual excess return of about 171%. In other words, risk arbitrage is a highly profitable investment strategy.

The event-time studies do show high returns, but do not consider the possibility of consistently investing in risk arbitrage over time. Such considerations are done in calendar-time studies, where a portfolio is created as a calendar time-series analysis and not on aggregate events. One of the most comprehensive calendar-time studies is done by Mitchell and Pulvino (2001) who examine 4,750 cash and stock mergers in the period from 1963 to 1998. They create a value-weighted risk arbitrage portfolio and a more realistic investor portfolio; accounting for transaction costs, including brokerage fees and price impact. The value-weighted portfolio showed statistically significant monthly excess returns of 0.74% in the period, the investor portfolio showed monthly excess return of 0.29%. They conclude that the exclusion of transaction costs are the reason that other studies find large abnormal returns.

However, they still find excess returns of about 4% yearly (0.29% monthly) when including transaction costs, confirming the notion that risk arbitrage do produce abnormal returns in a practitioner setting, and not just in academic research. They also argue that investing in risk arbitrage is like writing an uncovered put option, where the market risk should be a lot higher when the option is "in the money". By modelling a piece-wise linear regression, they conclude that the risk arbitrage portfolios exhibit zero market risk in flat and appreciating markets, but show statistically significant market risk in depreciating market conditions. When the market depreciation was more than 4%, they found a market beta of 0.5.

In a contemporary study, Baker and Savasoglu (2002) reach the same conclusion regarding abnormal returns, examining 1,901 cash and stock offers from 1981 to 1996. Their risk arbitrage portfolios generated monthly excess returns of 0.6 to 0.9%, whereas their value-weighted and equal-weighted CAPM alphas show excess returns of 0.78% and 0.84%, respectively. Interestingly, the results are very close to the CAPM alphas of the Nordic value-weighted and equal-weighted portfolios (0.54% and 1%, respectively, using European market returns). However, they do not find any excess returns for their value-weighted portfolios in the Fama-French Three-factor model. The authors conclude that the excess return, which arbitrageurs earn, is due to completion risk. Undiversified investors sell their shares in order to profit from the appreciated stock price, leaving the last spread to professional arbitrageurs and avoiding the completion risk. Jindra and Walkling (2004) analyses speculation spreads on 361 cash tender offers between 1981 and 1995, which they define as "the percentage difference between the bid price and market price one-day after the initial announcement". The characteristics of the speculation spreads are important for data comparison purposes. Interestingly, they find that 23% of speculation spreads are negative in the period, indicating that the target stock is higher valued in the market than the price offered by the acquirer. In my sample, almost 50% of all transactions had negative speculation spreads, which may indicate that spreads converge faster in the Nordic, and that more information reach the market before the actual bid. Regardless, the conditions for arbitrage seem less favorable in the Nordic markets. Jindra and Walkling (2004) also find mean and median speculation spreads of 1.86% and 1.96%, respectively. They find monthly excess returns of about 2%. Branch and Yang (2006), like Mitchell and Pulvino (2001) claim that their results show non-linear patterns in risk arbitrage portfolios consisting of 1,309 cash, stock and collar deals, but with no statistically significant results. However, they find statistically significant alphas. In a period

from 1990 to 2000, they find monthly excess returns of 1.5% and 1.7% for their cash and combined risk arbitrage portfolios, respectively.

The studies done outside the U.S. market are mainly confined to the rest of the English-speaking world. Sudarsanam and Nguyen (2008) examine 826 UK cash and stock mergers from 1987 to 2007. As in this paper, they create a practitioner portfolio limiting the position in any given transaction to a maximum of 10% and find statistically significant risk-adjusted returns in both CAPM and Fama-French-models to be about 0.5-0.6% per month. In addition, the practitioner portfolio has a beta of 0.11, so they conclude that the portfolio have close to market-neutral risk profile. The results are very similar to the Nordic practitioner arbitrage portfolio (monthly excess returns of 0.35% when benchmarked on European factors). The beta coefficients are lower in the Nordic markets (the largest is 0.06), although with the same conclusion regarding risk profile.

In Canada, examining 37 deals in 1997, Karolyi and Shannon (1999) find an average excess return of 4.78% during an average takeover duration of 57 days. They also argue that the Canadian market for risk arbitrage may be limited by the generally lower deal value compared to the U.S. Such a notion is interesting in a Nordic perspective, where deal sizes are relatively small compared to the U.S.

In the Australian market, Maheswaran and Yeoh (2005) find statistically significant excess return of 0.84-1.2% on equal and value-weighted cash portfolios constructed from 193 transactions between January 1991 and April 2000. When accounting for transaction costs, however, the results are not statistically significant. They also conclude that the risk arbitrage portfolios are market neutral. Hall, Pinnuck, and Thorne (2013) come to the same conclusion regarding cash portfolios in Australia. However, after examining 431 cash and stock deals over a 20-year period they conclude that the combined cash and stock portfolios inhabit market risk. In addition, they find excess return similar to other studies, with average monthly excess returns of 0.3% for their value-weighted portfolios.

One exception to the English-speaking markets is a study by McDermott and Mulcahy (2017). They examine 83 German transactions from 2003 to June 2007. With a similar research strategy as in this paper, they create equal weighted and value weighted portfolios, as well as a practitioner portfolio with realistic limitations. Their results are somewhat an exception to other studies and show that only the equal-weighted portfolio generate

statistically significant excess returns (only 0.002% per month). Consequently, they conclude that when real world constraints are applied, the risk is correctly priced in the German market. In other words, arbitrageurs in Germany cannot expect to earn excess return. The alpha values are similar to the Nordic portfolios benchmarked on the Nordic market returns, however, the market risk in the German risk arbitrage portfolios are in the range of 0.12 – 0.667, which are a lot higher than the Nordic market betas of around 0.05-0.15. Notably, the German portfolios generally have the largest market correlation of all the studies reviewed.

To summarize, contrasting this study, most of the previous studies conclude that there are excess returns in risk arbitrage. However, the evidence found in Germany are more in line with my results, finding almost no excess returns. In addition, most of the studies support the notion of risk arbitrage portfolios having market neutral risk characteristics. Having summarized the previous research, in the next section I describe the process of data collection that enables me to look at the profitability of risk arbitrage in the Nordics.

3. Data

The data section consists of three main parts. The first part explains what type of data is collected as well as how it is collected. The second part accounts for how the three risk arbitrage portfolios are constructed. The third part presents descriptive statistics of the constructed portfolios, for both the Nordic combined and broken down by country.

3.1 Data collection

The data in this paper include all public takeovers announced in the Nordic region during the period 2007 – 2016 and is collected from Zephyr, an extensive M&A database by the publisher Bureau Van Dijk. The Zephyr database offers a summary of each deal containing timelines and often statements from companies and stock exchanges. Zephyr is, according to Bureau van Dijk (2018), "*the most comprehensive database for deal information"*. The Nordics are defined as Norway, Sweden, Denmark and Finland. Only transactions where the target company is listed on the main (largest) stock exchange in each country are included. The exchanges are; Oslo Stock Exchange (Norway), OMX Stockholm Stock Exchange (Sweden), OMX Copenhagen Stock Exchange (Denmark) and OMX Helsinki Stock Exchange (Finland).

After the collection of data, every individual deal is analyzed to identify duplicates and erroneous listings. Only the transactions where the target company have one of the four exchanges as their main trading platform are included, e.g. companies with secondary listings on a Nordic exchange, but main listing on an exchange outside the Nordics are excluded. Target companies listed on multiple Nordic exchanges are attributed to their main exchange, e.g. home country or headquartered country.

The Swedish and Norwegian raw data also contains transactions from the smaller trading platforms Aktietorget (Sweden) and Oslo Axess (Norway). Compared to the main exchanges, Aktietorget and Oslo Axess generally list less liquid and lower market value stocks because of less requirements for listing. All transactions with target companies on these exchanges have been excluded from the study. A transaction in this paper refers to a bid by one entity or group on a target company. It is important to note that multiple bids on a unique

target company are treated as multiple transactions. After the removal of duplicate entries, erroneous listings, secondary listings and transactions where the target company is listed on other Nordic exchanges, the data comprises of 429 cash, stock and mixed transactions.

The stock price data for the 429 target companies is extracted from the Thomson Reuters DataStream database. The Zephyr database provides announcement dates, completion dates and identification codes (ISIN) for the companies. After manually going through the transactions, completion dates have been updated to reflect either expiration of a tender offer, or a delisting when a target is fully acquired. The ISIN numbers are used to easier identify the securities of the companies, but ISIN is an umbrella identification for a security issued by a company and do not specify exchange or currency. This is problematic when securities are listed on several exchanges and denominated in different currencies. To ensure that the correct security is included, price data securities are matched with the ticker-symbols of their respective exchange and currency. The stock price data is collected from the day of announcement until either the day of completion or the day after withdrawal. The price data is unadjusted market close stock prices. There are five transaction days every week regardless of closed markets in the respective countries. The Nordic countries have different holidays, resulting in varying trading days. To get consistent return data, the stock prices are padded; on a weekday where the stock market is closed, the stock price used is the last market close price available. Having described the collection of the raw data, I will continue the next section with a detailed description of how the data is processed and used to construct Nordic risk arbitrage portfolios.

3.2 Constructing portfolios

In this section, I account for the construction of the risk arbitrage portfolios. For the portfolios to make sense in a risk arbitrage investment strategy there are some restrictions and exclusions applied in this section.

I have constructed three portfolios containing all the Nordic data: one equal-weighted, one value-weighted and one practitioner arbitrage portfolio. In addition, I have partitioned the

data by country to examine differences in the Nordics. The calculation of each portfolio is described in detail below.

The data includes a small set of transactions that are announced but not yet completed per year end 2016, these transactions are still included and for calculation purposes the completion date is set to 31th of December 2016. The data contains 429 transactions where the bid consists of cash, stock and a mix of cash and stocks. There are 31 transactions with mixed payment. Transactions with mixed payment complicates the return calculations since the return is determined by both the cash settlement and the floating share price of the acquirer. The acquirer stock may also be listed in another currency. In addition, the mixed transactions may contain other special options or clauses, for example earn-outs or collars. The task of valuing special clauses and complex payment mixtures may ultimately prove impossible. Since the portfolios are created to mimic a passive fund, mixed deals and deals with other special clauses are excluded.

Of the 398 transactions left, only 37 are stock swap transactions. Relative to the 361 cash transactions, the stock transactions are few. Since the typical arbitrage approach to stock transactions is to both short the acquirer stock and go long in the target stock, both companies' stock price determine the return. In cash transactions, only the target company's stock price is relevant for the calculation of return. Since there are few stock transactions relative to cash transactions, they are excluded from the data to simplify the passive portfolios and make them more straightforward in terms of currency. After mixed deals and stock swap deals are dropped, the data consists of 361 cash deals. The average transaction duration is about 58 days. Of the 361 transactions, 85 were withdrawn and so the completion rate was about 76%. The targets have an average market value of EUR 357m (median of EUR 144m). Table 1 depicts descriptive statistics of the initial sample.

To construct monthly return portfolios, daily returns are compounded for all active transactions in a given month (see calculation and weighting of the specific portfolios for further details). The daily return is calculated from the market close price the day after announcement and until the deal is completed. The investment starts one day after announcement to avoid the bias of the large surge in price in announcement day. If a bid is withdrawn, the position is closed the day after withdrawal. A revised bid is initially treated as a withdrawn bid. However, since the bid is revised there will be a new simultaneous investment starting the day after announcement. Multiple bids are thus treated as multiple

transactions, even when the new bid is just a revision by the same acquirer. A transaction is finalized in one of three ways; the bid is withdrawn, the tender offer expires (without a delisting), or a target is acquired in full and delisted.

Any dividends declared during the investment period are included in the daily returns on the ex-dividend date. The formula below illustrates the daily return calculations:

$$Daily\ return\ R_{it} = \frac{P_{it} - P_{it-1} + D_{it}}{P_{it-1}} \qquad (1)$$

R refers to the daily returns. *P* is the market close price of the target share. *D* refers to any dividends on the given time (day). The subscript *t* denotes the time (day), and thus *t-1* refers to the market close price of the share on the previous day. The subscript *i* refers to the transaction number.

Table 1 – Descriptive statistics of total sample

The table contains a summary of all 361 transactions included in the data. The period is from 2007 to 2016. The number of announced transactions are in the specified calendar year. The listed transaction duration are in padded trading days, weekends are not included. The number of transactions completed and withdrawn may include transactions announced in a previous year. The market values are calculated from market close the day after the transaction announcement. The listed market values are in millions of EUR.

Year	Announced transactions	Average transaction duration	Withdrawn transactions	Completed transactions	Mean Market Value - Target	Median Market Value - Target
2007	48	69	10	38	518.5	244.3
2008	55	60	15	40	260	105
2009	38	59	7	31	267	42.4
2010	36	40	10	26	226.8	82.6
2011	29	52	4	25	479.6	93.9
2012	30	83	4	26	276	91.5
2013	28	56	6	22	374.9	144.5
2014	46	54	16	30	498.1	99.4
2015	24	52	3	21	202.3	48.3
2016	27	51	10	17	467.3	489.5
All	36.1	57.6	8.5	27.6	357.05	144.14

3.2.1 Exclusions

To mimic a passive investment portfolio, the investor is expected to base the investment decision on an opportunity for positive return in absolute terms. For the chance of a positive return, the bid price has to be higher than the share price at the time of investment; the takeover premium has to be positive. In the risk arbitrage portfolios in this paper, the time of investment is defined as the market close, one day after the announcement of an *actual* bid. In the rest of this paper, the premium on the day after announcement is referred to as *speculation premium*. First, the bid have to be definitive bid. In the data, there are some transactions where the acquirer announces its intention to make a bid for a specific price per share within a specified timeframe. After an announcement of a future bid, the stock price will likely appreciate and mark an opportunity for risk arbitrageurs, but it is not necessarily binding. The bidder can still decide to drop the planned bid. An acquirer that have triggered a mandatory bid by reaching an ownership threshold is an illustration of the indefinite nature of such an announcement. In such a case, the stock exchange expects the acquirer to announce a bid within a specified timeframe; however, the acquirer can just as well choose to reduce its target stock position below the ownership threshold. Second, the speculation premium have to be positive for there to be a risk arbitrage opportunity. In the 361 cash transactions described above, the speculation premium is negative in 179 of the transactions. Since there is no risk arbitrage opportunity in these transactions, they are excluded from the portfolios. The final portfolio data thus contains 182 cash transactions.

3.2.2 Equal-weighted risk arbitrage portfolio

Of the three portfolios created, the equal weighted portfolio is the simplest. The portfolio is invested in an equal position in all active transactions, e.g. if there are five transactions, each target company will be held at a 1/5 position. The calculation is described in Formula 3 below:

$$Daily\ equal-weighted\ returns\ R_{EW} = \frac{\sum_{i=1}^{N_i} R_i}{N_i} \qquad (2)$$

N represents all active deals on day *i*. Since the equal weights do not factor in the market value of the target company, it is a somewhat unrealistic approach. Some targets can be worth ten-folds the amount of others, which in turn indicates a much higher availability of shares. There would simply be liquidity constraints unless the invested amount is unrealistically small. The equal-weighted portfolio is mainly included for comparison.

To construct monthly return portfolios, the daily returns are compounded, as seen in formula 4:

$$Monthly\ returns\ R = \prod_{t=1}^{T}(1 + R_i) - 1 \qquad (3)$$

3.2.3 Value-weighted risk arbitrage portfolio

The value-weighted portfolio is weighted by the market value of the target company. This is a more realistic approach as the targets with large market value are likely to have more liquid shares. The weights for the value-weighted positions are the market value on the day after the bid announcement. The portfolio consists of targets denominated in four different currencies; Norwegian krone (NOK), Swedish krona (SEK), Danish krone (DKK) and Euro (EUR). Comparable studies are conducted using transactions in a single market and have not addressed multiple currencies. To get comparable weights, the market value for all targets are converted to Euros. The currency exchange date are the day after bid announcement. The WM/Reuters exchange rates are used in all currency calculations (retrieved from Thomson Reuters DataStream). The currency calculations are done as follows:

$$Currency\ V_{iEUR} = \frac{1}{X_{ct}} * V_{ic} \qquad (4)$$

V refers to the market value of the target company on the day after bid announcement and the subscript *i* refers to the specific target company. *X* refers to the exchange rate on the day after

bid announcement and subscript *c* is the native currency. Finnish targets are already denominated in EUR and are thus not converted. The calculation of the value-weighted returns are shown in Formula 6.

$$Daily\ value-weighted\ returns\ R_{VWDR} = \sum_{i=1}^{N_i}\left(\frac{V_i(R_{it})}{\sum_{i=1}^{N_i} V_i}\right) \qquad (5)$$

Ni refers to the total number of *N* deals on day *i*. All market values *V* are denominated in Euro. The value-weighted monthly returns portfolio is compounded value-weighted daily returns, see formula 4.

3.2.4 Practitioner arbitrage portfolio

The risk arbitrage portfolio are created to mimic professional arbitrageurs. Investors in risk arbitrage are typically hedge funds or other highly professional individuals with some degree of risk aversion. To avoid an extreme downside in a specific deal, hedge funds typically limit their position in any given transaction to a maximum of 10% of their portfolio (Moore, Lai, and Oppenheimer 2006). This approach is used in the construction of the practitioner arbitrage portfolio. If there are fewer than ten deals in one month or excess capital because of relative market value, the excess position is invested in the risk free rate. Except for the limit of 10% and the addition of risk free rate, the calculation procedure is the same as the value-weighted portfolio. The practitioner portfolio reflects a professional approach to a passive risk arbitrage portfolio better than the two other portfolios. The maximum position limit is the same as the approach of (Sudarsanam and Nguyen 2008; Mitchell and Pulvino 2001) and similar to that of Mitchell and Pulvino (2001).

3.2.5 Market portfolios

There are two main market portfolios used in this study, one for the Nordic market and one for the European market. The main reason for the use of two different indices is the use of both Norwegian and European Fama-French factors. Since this study aims to describe the risk and return of merger arbitrage portfolios with mixed country origin, the risk free rate, market proxy and the mentioned factors are not readily available. My solution is to use two different market proxies, and then compare the results, as well as compare the results to previous studies.

The CAPM model assumes that the market portfolio include every possible investment. Roll (1977) criticizes the unrealistic approach of observing such a broad market portfolio that includes all risky assets. The practical approach to the problem is to use a proxy for the market portfolio that covers as much of the market as possible.

The Nasdaq OMX Nordic 120 is chosen as a proxy for the Nordic market portfolio. The index is composed of the 120 largest free-float market capitalization shares of the 150 most traded shares on the four Nordic exchanges (Nasdaq 2018). The free-float adjustment refers to shares that are actually tradeable in the market. In practice, this reduces the weight of shares with large institutional and private long-term owners (e.g. partially publicly owned companies like Statoil and DNB). Since the risk arbitrage portfolios include the reinvestment of dividends, the index used in this paper is the total return index (TR). The European market portfolio is retrieved from Kenneth French's research along with the European risk free rate and include 12 Western-European markets in addition to the four Nordic countries (French 2018).

3.2.6 Transaction and trade costs

Transaction and trade costs have been left out entirely to simplify the construction of portfolios, but it is important to note that some restrictions exist in a practical risk arbitrage portfolio investment. The most obvious is the direct costs (brokerage fee), charged to expedite buy and sell orders. When rebalancing portfolios often, the direct costs will affect returns. However, due to the rising popularity of automated online platforms these costs are declining. There is also the more indirect cost of price impact. When an investor places a buy order of

some size, it affects the availability, the ask-bid spread and the price itself. Both Mitchell and Pulvino (2001) and McDermott and Mulcahy (2017) find that transaction costs affects excess returns in risk arbitrage.

3.3 Description of the constructed risk arbitrage portfolios

The combined Nordic portfolio consists of 182 transactions from the four Nordic countries. The first transaction starts on the 13th of March 2007, and the last transaction ends on the 29th of November 2016. Since the two first months of 2007 and the last month of 2016 have no active transactions in the final sample, they are dropped, giving the data a time-period of 117 months in total. Table 2 presents descriptive statistics of the Nordic portfolio data. Table 3 presents descriptive statistics of the Norwegian and Swedish data, while Table 4 presents descriptive statistics of Danish and Finnish data.

There is, on average, about 18 transactions announced every year. The highest number of transactions announced in any given year is 32 (in 2008). In the same year, there were 38 active transactions. This means that 6 transactions were neither completed nor withdrawn at year-end of 2007, and thus still active in 2008.

On average, there is about 6 active transactions every month, and the average transaction duration is 61 days. 31 of 182 transactions are withdrawn in the period, about 17%, or an average of 3 per year. In 2015, 14 transactions were completed and none withdrawn. The same year also saw the lowest average market value, only EUR 79.3m, while the median was EUR 47.7m. In contrast, the average market value in the full period is EUR 372m, and the median is EUR 105.8m.

When looking at the country specific portfolio data, there is an overweight of Norwegian and Swedish transactions. All statistics refer to the target country of origin, and thus the country where the risk arbitrage portfolios are invested. About 77% of all transactions involve targets from the Norway or Sweden. In the period, there were 81 Norwegian and 59 Swedish transactions. Danish and Finnish transactions amounted to 25 and 17 transactions, respectively. As a natural consequence, the largest portion of the monthly active transactions are in Norwegian and Swedish targets, about 2 every month on average. The average duration of transactions are about the same for the Norwegian and Swedish data (57 and 56 trading days, respectively), but lower for the Danish panel (36 trading days). Surprisingly, the Finnish

Table 2 - Descriptive statistics of risk arbitrage portfolios – Nordic

The table shows descriptive statistics for the 182 portfolio transactions. *Active Transactions* include transactions, if any, continued from the previous year. Market values are in millions of EUR. The "All" row of Median Market Value – Target is the median for the whole period, the rest is yearly averages. The period is from March 2007 to December 2016. There are 10 months in 2007, and 11 months in 2016, 117 months in total.

Nordic transactions N = 182

Year	Announced Transactions	Active Transactions	Average Active Transactions per Month	Average Transaction Duration	Withdrawn Transactions	Completed Transactions	Mean Market Value - Target	Median Market Value - Target
2007	21	21	7.2	71	1	13	299.5	211.3
2008	32	38	9.8	66	5	28	282.4	107
2009	18	24	6.1	61	4	16	237.9	58
2010	15	19	3.8	49	3	13	190.6	75.9
2011	16	19	4.1	45	2	15	747.8	167.3
2012	17	19	3.8	46	1	14	344.8	39.5
2013	13	17	4.9	83	3	12	535.9	284.6
2014	30	32	7.7	64	9	16	534.1	98.7
2015	9	16	4.2	53	0	14	79.3	47.7
2016	11	13	5.1	76	3	10	335.2	307.3
All	18.2	21.8	5.7	61.4	3.1	15.1	371.9	105.8

transactions have an average duration of almost 113 trading days – in 2008, it is as high as 210 days.

As Table 3 shows, Swedish transactions are the most likely to fail; about 25% of all announced transactions are withdrawn in the period. Denmark, Norway and Finland have failure-rates of 16%, 13% and 6%, respectively. Interestingly, only one of the announced transactions are withdrawn in Finland during the period. On average, the most valuable target companies are Danish. The average Danish target have a market value of EUR 489m in the period. However, Denmark also have the lowest median target market value (EUR 78m), indicating that there are a few large companies increasing the average. The Swedish average target market value is EUR 413m, with a median target market value of EUR 100m. Norway and Finland have average target market values of EUR 340m and EUR 208m respectively. The Norwegian and Finnish targets consist of a larger proportion of companies above EUR 100m worth, with a median target market value of EUR 133m and EUR 145m, respectively.

Table 3 - Descriptive statistics of risk arbitrage portfolios – Norway and Sweden

The table shows descriptive statistics for the 81 Norwegian and 59 Swedish transactions in the risk arbitrage portfolios. *Active Transactions* include transactions, if any, continued from the previous year. Market values are in millions of Euros. The "All" row of Median Market Value – Target is the median for the whole period, the rest is yearly averages. The period is from March 2007 to December 2016. There are 10 months in 2007, and 11 months in 2016, 117 months in total.

Panel A: Norwegian transactions N = 81

Year	Announced Transactions	Active Transactions	Average Active Transactions per Month	Average Transaction Duration	Withdrawn Transactions	Completed Transactions	Mean Market Value - Target	Median Market Value - Target
2007	9	9	2.5	50	1	8	313.4	211.3
2008	16	17	3.8	50	1	15	383.4	181.6
2009	11	13	3.1	67	3	8	341.9	57.1
2010	7	11	2.1	42	2	5	135.9	75.9
2011	6	7	1.6	53	0	6	281.9	167.3
2012	7	8	1.3	30	1	6	652.8	118.6
2013	6	7	2.6	109	0	6	277	192.6
2014	13	15	2.9	66	1	12	341.3	249.4
2015	3	8	2.4	35	0	3	58.9	39.7
2016	3	3	1.1	67	2	1	457.3	332.8
All	8.1	9.8	2.3	56.9	1.1	7	340.4	133.1

Panel B: Swedish transactions N = 59

Year	Announced Transactions	Active Transactions	Average Active Transactions per Month	Average Transaction Duration	Withdrawn Transactions	Completed Transactions	Mean Market Value - Target	Median Market Value - Target
2007	7	7	2.6	75	0	7	270.8	112.2
2008	10	13	3.8	80	3	7	233.1	133
2009	4	6	1.4	40	1	3	90.2	103.2
2010	5	5	0.9	60	1	4	326	140
2011	3	5	1.2	46	0	3	311	22.1
2012	4	5	0.9	55	1	3	31.4	31
2013	4	6	1.1	40	2	2	1,246.3	1,258.5
2014	13	13	3.2	49	6	7	801.2	98.5
2015	6	7	1.4	62	0	6	89.6	48.3
2016	3	5	1.5	53	1	2	379.3	489.5
All	5.9	7.2	1.8	56	1.5	4.4	412.7	99.8

Table 4 – Descriptive statistics of risk arbitrage portfolios – Denmark and Finland

The table shows descriptive statistics for the 25 Danish and 17 Finnish transactions in the risk arbitrage portfolios. *Active Transactions* include transactions, if any, continued from the previous year. Market values are in millions of Euros. The "All" row of Median Market Value – Target is the median for the whole period, the rest is yearly averages. The period is from March 2007 to December 2016. There are 10 months in 2007, and 11 months in 2016, 117 months in total.

Panel A: Danish transactions N = 25

Year	Announced Transactions	Active Transactions	Average Active Transactions per Month	Average Transaction Duration	Withdrawn Transactions	Completed Transactions	Mean Market Value - Target	Median Market Value - Target
2007	2	2	0.4	25	0	2	300	300
2008	4	4	0.5	23	1	3	126	91.6
2009	2	2	0.2	22	0	2	4.9	4.9
2010	2	2	0.4	38	0	2	31.8	31.8
2011	6	6	1.2	40	2	4	1,549.9	299.2
2012	3	3	0.4	29	0	3	322.2	330.8
2013	2	3	0.7	60	0	2	17.2	17.2
2014	1	1	0.3	72	1	0	28.7	28.7
2015	0	0	0	0	0	0	0	0
2016	3	3	0.9	50	0	3	237.4	175.9
All	2.5	2.6	0.5	35.9	0.4	2.1	488.7	78.2

Panel B: Finnish transactions N=17

Year	Announced Transactions	Active Transactions	Average Active Transactions per Month	Average Transaction Duration	Withdrawn Transactions	Completed Transactions	Mean Market Value - Target	Median Market Value - Target
2007	3	3	1.7	154	0	3	324.1	268.9
2008	2	4	1.7	210	0	2	33.6	33.6
2009	1	3	1.3	157	0	1	150.9	150.9
2010	1	1	0.3	66	0	1	213.7	213.7
2011	1	1	0.2	31	0	1	41.3	41.3
2012	3	3	1.2	84	0	3	66.7	40.6
2013	1	1	0.6	143	0	1	284.6	284.6
2014	3	3	1.2	119	1	2	381.1	58.5
2015	0	1	0.4	0	0	0	0	0
2016	2	2	1.5	164	0	2	232.6	232.6
All	1.7	2.2	1	112.8	0.1	1.6	208.1	144.6

Table 5 – Observed transactions per month

The table presents the number of months with n transactions from March 2007 to December 2016. There is a total of 117 months. E.g., the Nordic portfolios had 9 months with only 1 transaction, and 9 months with 10 or more transactions.

N = 117 months

Number of transactions	Nordic portfolios	Norwegian portfolios	Swedish portfolios	Danish portfolios	Finnish portfolios
0	0	8	18	72	38
1	9	30	43	32	48
2	4	30	30	12	25
3	15	25	11	1	6
4	15	13	6	-	-
5	17	9	3	-	-
6	11	2	6	-	-
7	17	-	-	-	-
8	10	-	-	-	-
9	10	-	-	-	-
10 or more	9	-	-	-	-

Interestingly, during the year of 2015, there are no announced or active transactions in Denmark, and no announced transactions in Finland. This fact demonstrates the lack of data when partitioning the Nordic sample on the specific countries. With only 25 and 17 transactions over a ten-year period, the Danish and Finnish data have relatively few transactions compared to the Norwegian and Swedish. This is further confirmed when we observe that in the full period, the Danish data had 72 months without any transactions, and only 13 months with more than 1 transaction. The Finnish portfolios have more active transactions (mainly due to much longer duration than the other countries), but still 38 months or 33% of the period without any transactions. The Norwegian data have 8 months, and the Swedish data 18 months, without any transactions. The Nordic data have at least one active transaction every month, and have more than 5 monthly transactions in over half the period. Table 5 presents the full frequency of monthly transactions, both combined and broken down by country.

The presentation of the constructed portfolios conclude this section. The next section explore the performance of the described portfolios in both absolute and risk-adjusted returns, as well as their risk characteristics.

4. Empirical analysis and results

In this section, I first present the absolute returns of the different risk arbitrage portfolios. I then move on to the factor models, presenting each benchmark model and corresponding results.

4.1 Empirical analysis with factor models

To analyze risk and excess return, I will use three different linear models: the Capital Asset Pricing Model (CAPM) and the Fama-French Three-Factor model with and without a liquidity factor. The relationship between the risk arbitrage portfolios and the market return is estimated through Ordinary Least Squares regressions. The CAPM regression formula is as follows:

$$R_p - R_f = \alpha + \beta_m(R_m - R_f) \qquad (6)$$

R_p is the returns of the asset being benchmarked, the value-weighted and equal-weighted monthly returns risk arbitrage portfolios. R_f is the risk free rate of return. The risk free rate of return is subtracted from the risk arbitrage portfolio rate of return to get the portfolio excess return. The α (alpha) is the intercept in the equation. In the CAPM, the α measures excess returns of the asset relative to the market returns. In our case, a positive alpha indicates that the risk arbitrage portfolio outperforms the market index. The constant β_m (beta) measures the systematic risk of the asset returns R_p relative to the market returns R_m. Since CAPM measures excess returns, the risk free rate of return is subtracted from the market rate of return R_m (to get the risk premium).

The Fama-French three-factor model builds further on the CAPM model and includes the additional factors *Small minus Big* (SMB) and *High minus Low* (HML).

$$R_p - R_f = \alpha + \beta_m(R_m - R_f) + \beta_{SMB}SMB + \beta_{HML}HML \qquad (7)$$

The SMB factor refers to the historic excess returns of small-cap companies over large-cap companies. The HML is the historical excess returns of high vs. low book-to-market companies. Research by Fama and French (1993) show that small-cap companies have consistently outperformed large-cap companies, and that companies with high book-to-market ratios have outperformed companies with low book-to-market ratio. Since the factors are market specific, there are no universal factors applicable to all models (Griffin 2018). There are, however, factors calculated for specific countries and regions following the calculation framework described by Fama and French. I estimate the Fama-French three-factor model both with Norwegian risk free rate, Nordic market returns and factors as well as with European risk free rate, market returns and factors. The European factors, risk free rate and market return are calculated by Kenneth French (French 2018), while the Norwegian factors and risk free rate are calculated by Bernt Arne Ødegaard (Ødegaard 2018a).

To assess whether there is any risk associated with the liquidity of the portfolios, I also estimate the Fama-French Three-factor model with a liquidity factor calculated from daily observations of the Oslo Stock Exchange by Bernt Arne Ødegaard (Ødegaard 2018b). Formula 9 presents the liquidity model:

$$R_p - R_f = \alpha + \beta_m\left(R_m - R_f\right) + \beta_{SMB}SMB + \beta_{HML}HML + \beta_{LIQ}LIQ \qquad (8)$$

The results from the factor models are divided into two different parts. First, I present the results for the combined Nordic portfolios, both in absolute returns and for the factor models. I then proceed to the results for the specific countries, presenting both absolute returns and factor models.

4.2 Nordic risk arbitrage portfolios

4.2.1 Nordic risk arbitrage returns

Table 6 presents the annual return of the constructed risk arbitrage portfolios, the Nasdaq OMX Nordic 120 index, as well as the risk-free rate of return. The annual returns are compounded monthly returns. In absolute returns, the Nasdaq OMX Nordic 120 beats the practitioner arbitrage portfolio in 7 out of 10 years. The index also has a substantial higher compound annual growth rate (CAGR) of more than 6%, where the practitioner portfolio have a rate of 4.8%. The practitioner arbitrage portfolio had positive returns in all 10 years, with 2015 boasting the highest (14.6%). As expected, the practitioner portfolio seems less volatile than the equal and value-weighted portfolios. The equal-weighted risk arbitrage portfolio had a positive return in nine of the 10 years, with the highest return being about 31.7% in 2015. When comparing the three risk arbitrage portfolios, the equal-weighted seems to outperform the value-weighted and practitioner portfolios, boasting higher returns in seven of the 10 years and a higher compounded annual growth rate.

In 2008, during a year of high financial distress, only the practitioner portfolio had a positive return (0.72%). The market index suffered negative returns while the risk-free rate of return was at its highest in the period. The risk arbitrage portfolios are expected to exhibit much lower volatility, and thus should give lower absolute returns than the market, but only the PA portfolio have a lower CAGR than the market.

Figure 1 presents an indexed performance graph of the three risk arbitrage portfolios and the Nasdaq OMX Nordic 120 index. The portfolios' base value in the start of 2007 are set to 100. The graph shows the superior cumulative performance of the equal-weighted risk arbitrage portfolio.

Table 6 – Yearly Nordic risk arbitrage portfolio returns

The table contains the annual return of the value-weighted, equal-weighted, practitioner arbitrage portfolios, as well as the returns of the Nasdaq OMX Nordic 120 index and the European market. The risk arbitrage portfolios contains all positive premium deals in the period. CAGR is the compound annual growth rate. The period is from March 2007 to December 2016.

Year	Value-weighted Portfolio	Equal-weighted Portfolio	Practitioner Arbitrage Portfolio	Nasdaq OMX Nordic 120	European Market	Risk free rate of return
2007	9.50%	11.90%	4.80%	8.80%	9.27%	4.96%
2008	-3.80%	-6.52%	0.72%	-49.95%	-46.74%	6.18%
2009	8.96%	6.80%	4.32%	50.75%	35.21%	2.19%
2010	10.81%	12.53%	4.61%	37.03%	6.27%	2.34%
2011	6.06%	24.60%	2.89%	-14.82%	-13.17%	2.66%
2012	3.52%	6.32%	2.70%	21.25%	20.78%	1.95%
2013	9.03%	2.36%	3.30%	22.34%	27.98%	1.68%
2014	-0.47%	8.22%	3.91%	10.68%	-6.41%	1.61%
2015	10.59%	31.65%	6.82%	15.43%	-0.52%	1.26%
2016	15.70%	23.05%	14.61%	1.75%	-0.03%	0.95%
CAGR	6.84%	11.57%	4.81%	6.33%	0.44%	2.57%

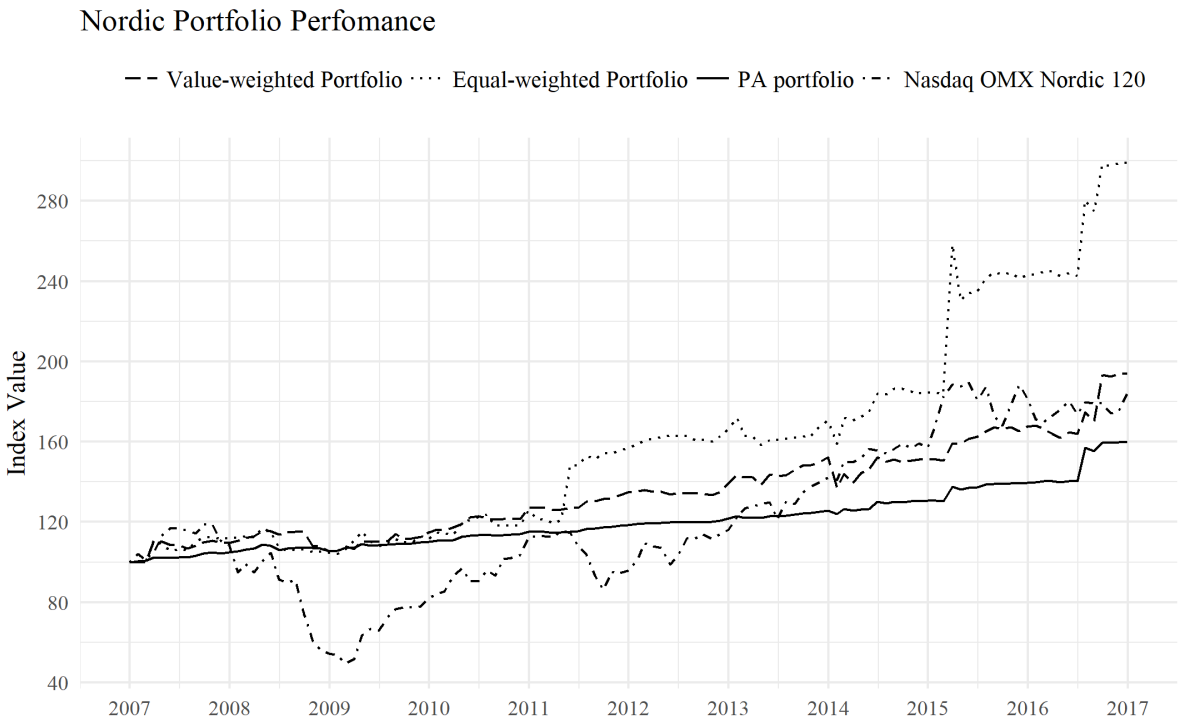

Figure 1 – Cumulative portfolio returns 2007-2016 - Nordic

The graph shows the performance of the value-weighted, equal-weighted and practitioner risk arbitrage portfolios compared to Nasdaq OMX Nordic 120 market index from 2007 to 2016. All four portfolios start at the same base level of 100.

4.2.2 Nordic Capital Asset Pricing Model (CAPM)

The results for the CAPM with the Nordic market index show no statistically significant excess return for any of the three risk arbitrage portfolios. All the betas are statistically significant, but fairly close to zero. The equal-weighted portfolio exhibits the highest beta coefficient, 0.147, which is still low and indicating little systematic risk. The practitioner portfolio has a beta coefficient of 0.05 at the 1% significance level (model 3 in Table 7). As expected, the PA portfolios have the lowest beta values, because of the heavy weighting towards the risk-free rate.

The regressions on the European market all have statistically significant excess return, with the equal-weighted portfolio outperforming the European market by about 1% per month. The value-weighted portfolio and the PA portfolio show monthly excess returns of 0.5% and 0.35%, respectively. The value-weighted portfolio have a statistically significant low beta of 0.079, indicating very low systematic risk. The beta values of the equal-weighted and PA portfolios are not statistically different from zero, indicating both portfolios have a market neutral risk characteristic.

The R-squared values are generally very low, with the highest value being 0.065 for the value-weighted portfolio on the Nordic market index. It is not unusual to observer low R-squared values in previous risk arbitrage research, Mitchell and Pulvino (2001) have adjusted R-squared values of 0.006 and 0.057 for their value-weighted and practitioners arbitrage portfolios respectively. However, low R-squared values may indicate that the CAPM is a poor fit for the data.

Table 7 – Nordic CAPM results

The table contains the results from the CAPM model. Models 1-3 are regressed on the Nasdaq OMX Nordic 120 index as a proxy for the Nordic market premium with the Norwegian risk-free rate. Models 4-6 are regressed on the European market premium with the European risk-free rate. VWMR is the Value-weighted Monthly Return portfolio, EWMR is the Equal-weighted Monthly Return portfolio, and PA is the Practitioner Arbitrage portfolio. Standard errors in parenthesis.

	VWMR (NO)	EWMR (NO)	PA (NO)	VWMR (EU)	EWMR (EU)	PA (EU)
	(1)	(2)	(3)	(4)	(5)	(6)
α	0.340	0.784	0.173	0.535**	0.999**	0.350***
	(0.229)	(0.478)	(0.124)	(0.231)	(0.482)	(0.124)
$\beta_{M\ Nordic}$	0.115***	0.147*	0.050**			
	(0.041)	(0.085)	(0.022)			
$\beta_{Market\ EU}$				0.079**	0.040	0.025
				(0.039)	(0.081)	(0.021)
N	117	117	117	117	117	117
R^2	0.065	0.026	0.043	0.035	0.002	0.012

Notes:
***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

4.2.3 Nordic Fama-French Three-factor model

In total, six Fama-French Three-factor models are estimated. All estimated models are presented in Table 8. Model 1-3 are estimated with Norwegian HML and SMB factors, Norwegian risk-free rate of return and the Nasdaq OMX Nordic 120 as a market proxy. Model 4-6 are estimated with European HML and SMB factors, European risk-free rate and European market risk premium. The results are similar to the CAPM regressions. All the models regressed on the European market rate show statistically significant monthly excess returns, ranging from 0.39% to 0.97%. The results are similar to previous research done in the U.S. (Mitchell and Pulvino 2001; Baker and Savasoglu 2002). However, they are substantially higher than the research done by McDermott and Mulcahy (2017) on German risk arbitrage; where their equal-weighted risk arbitrage portfolio generates excess returns of only 0.002%, my equal-weighted portfolio generates monthly excess returns of almost 1%. As with the CAPM results, only the value-weighted portfolio shows both statistically significant excess return (0.5% monthly) and a statistically significant beta coefficient of 0.1. The beta value is

Table 8 – Nordic Fama-French Three-factor results

The table contains the results from the Fama-French Three-factor model. The three factors coefficients are *Beta*, *Small minus Big (SMB)* and *High minus Low (HML)*. There are six estimated models, (1), (2) and (3) with Norwegian factors and risk-free rate, (4), (5) and (6) with European factors and risk-free rate. VWMR is the Value-weighted Monthly Return portfolio, EWMR is the Equal-weighted Monthly Return portfolio, and PA is the Practitioner Arbitrage portfolio. Standard error in parenthesis.

	VWMR (NO)	EWMR (NO)	PA (NO)	VWMR (EU)	EWMR (EU)	PA (EU)
	(1)	(2)	(3)	(4)	(5)	(6)
α	0.335	0.773	0.160	0.500**	0.972**	0.338***
	(0.233)	(0.485)	(0.126)	(0.232)	(0.488)	(0.126)
β_M NO	0.112**	0.145	0.057**			
	(0.051)	(0.106)	(0.027)			
SMB NO	-0.001	0.005	0.022			
	(0.072)	(0.150)	(0.039)			
HML NO	-0.047	-0.080	-0.034			
	(0.064)	(0.134)	(0.035)			
β_M EU				0.105**	0.069	0.034
				(0.046)	(0.096)	(0.025)
SMB EU				0.143	-0.023	0.056
				(0.116)	(0.245)	(0.063)
HML EU				-0.107	-0.131	-0.035
				(0.111)	(0.235)	(0.060)
N	117	117	117	117	117	117
R^2	0.070	0.029	0.052	0.057	0.005	0.022

Notes:
***Significant at the 1 percent level.
**Significant at the 5 percent level.
*Significant at the 10 percent level.

low, close to zero, and in practical economic terms, the portfolio exhibits a market neutral risk profile.

The Nordic market returns are the natural benchmark when assessing the existence of excess returns in Nordic risk arbitrage. The results are clear: none of the portfolios exhibit statistically significant excess returns when benchmarked on the Nordic market returns. This is in stark contrast to most previous research. The results indicate that there are no excess returns for arbitrageurs in the Nordic markets. For the value-weighted and the PA portfolio, the market betas are statistically significant but low. Ranging from 0.057 to 0.112 (for VW and PA, respectively), they indicate that the portfolio risk profiles are close to market-neutral.

The beta values are similar to the research results on cash tender offers by Branch and Yang (2006) and Mitchell and Pulvino (2001). They are however slightly lower than the results of Baker and Savasoglu (2002) and substantially lower than the research on the German market by McDermott and Mulcahy (2017). The exposure to the SMB and HML-factors are not statistically significant in any of the portfolios.

The R-squared levels for the Fama-French three-factor regressions are in the same range as the CAPM regressions. The R-squared is very low for all six estimations. The equal-weighted portfolio with European factors have the lowest R-square, 0.005. The largest value is found in the estimation of the value-weighted portfolio with Norwegian factors, 0.070.

4.2.4 Nordic Fama-French Three-factor model with liquidity factor

The results from the liquidity factor regressions are depicted in Table 9. They are almost the same as the Fama-French Three-factor results. The only statistically significant difference is the beta coefficient of the value-weighted portfolio on European factors; it is no longer statistically significant. All three risk arbitrage portfolios with European factors have statistically significant excess returns; 0.48%, 0.91% and 0.36% for the value-weighted, equal-weighted and practitioner arbitrage portfolios, respectively. As in the Fama-French Three-factor model, there are no excess returns in the Nordic market benchmarks. The Nordic market betas are statistically significant for the value-weighted and practitioner arbitrage portfolios, but are close to zero (0.1 and 0.06, respectively), indicating that the portfolios are almost neutral in terms of market risk.

None of the portfolios are sensitive to the liquidity factor. At first glance, this insensitivity indicates that the portfolios do not adhere more risk due to illiquid assets. It is, however, important to note that the factor is calculated with historic market data from the Oslo Stock Exchange, and may not be a good indicator for a combined Nordic portfolio.

Table 9 – Nordic Fama-French Three-factor with liquidity factor results

The table contains results for three Nordic risk arbitrage portfolios. The value-weighted (VWMR), the equal-weighted (EWMR) and the practitioner arbitrage (PA) portfolio. In models 1-3 the Norwegian risk-free rate is subtracted in the dependent variable. In models 4-6 the European risk-free rate are subtracted from the dependent variable. β_M is the Nasdaq OMX Nordic 120, β_M EU is the European market return. The portfolios are regressed on both the Norwegian and European HML and SMB-factors, as well as the Norwegian liquidity factor. Standard error in parenthesis.

	VWMR (NO)	EWMR (NO)	PA (NO)	VWMR (EU)	EWMR (EU)	PA (EU)
	(1)	(2)	(3)	(4)	(5)	(6)
α	0.323	0.770	0.170	0.475**	0.909*	0.335***
	(0.237)	(0.495)	(0.128)	(0.233)	(0.492)	(0.127)
β_M	0.106*	0.144	0.062**			
	(0.055)	(0.115)	(0.030)			
SMB NO	0.011	0.008	0.011			
	(0.087)	(0.181)	(0.047)			
HML NO	-0.048	-0.080	-0.034			
	(0.064)	(0.134)	(0.035)			
β_M EU				0.075	-0.009	0.030
				(0.058)	(0.121)	(0.031)
SMB EU				0.148	-0.012	0.056
				(0.117)	(0.245)	(0.063)
HML EU				-0.106	-0.127	-0.035
				(0.111)	(0.235)	(0.061)
LIQ NO	-0.023	-0.006	0.020	-0.065	-0.163	-0.008
	(0.087)	(0.181)	(0.047)	(0.073)	(0.155)	(0.040)
N	117	117	117	117	117	117
R^2	0.070	0.029	0.054	0.063	0.015	0.023

Notes:

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

4.3 Country specific risk arbitrage portfolios

4.3.1 Country specific returns

The country specific data include value-weighted, equal-weighted and practitioner arbitrage portfolios for each of the four Nordic countries. Table 10 depicts the country specific returns. The table also shows the yearly returns of the country specific all-share indices. In the period, only the Finnish equal-weighted and practitioner arbitrage portfolios had higher compounded annual growth rate than their respective markets.

Notably, the Norwegian value-weighted portfolio had a negative return of over 20% in 2016. This is mainly because of a failed acquisition of the software company Opera by Chinese Kunqi. In the four days before the announcement of deal failure, the Opera share fell over 11%, and on the day of the bid withdrawal, it fell another 10%. In the entire ten-year period, the value-weighted Norwegian portfolio shows negative returns in 4 out of 10 years, with a CAGR of only 0.31%. The performance is the lowest of all four value-weighted portfolios, with the Swedish value-weighted portfolio having the highest CAGR (5.43%); it also has the best average performance of all the risk arbitrage portfolios. Contrary to the combined Nordic portfolio, only the Finnish equal-weighted have a higher CAGR than its benchmark index, and that is only due to an exceptional return of over 45% in 2016. Nevertheless, the Finnish equal-weighted portfolio only outperformed the Finnish market in 3 out of 10 years, where two of them were severe downturns (2008 and 2011).

The practitioner arbitrage portfolios are generally outperformed by the markets. The exception is Finland, where the portfolio outperforms the market with 4 basis points. This is again due to an exceptional performance in 2016. The PA portfolios CAGR range from about 1.5% in Denmark to 2.8% in Norway. Interestingly, compared to the risk free rate in Table 6 (2.57%), the Danish PA underperforms with almost 100 basis points. The other three PA portfolios barely outperform the risk free rate. There is, however, a valid reason for the weak performance. As presented in Table 5, the Danish and Finnish portfolios include very few active transactions, and do have 72 and 38 months, respectively, without a single active transaction in the period. Compared to the Norwegian and Swedish portfolios, they have considerably fewer months (8 and 18, respectively), with no active transactions. The PA portfolios are particularly affected by the few active transactions, as 100% of the portfolio is invested in the respective countries' risk free rate in these months. Both Denmark and Finland

had months with negative risk free rates during the period, meaning that the PA actually lost money in some months without transactions. This is clearly observable in the Danish PA portfolio of 2016, where there were no active transactions for the whole year, and thus the portfolio had a return corresponding to the 3 month Danish deposit interest of -0.51%.

Figure 2 contains a visual presentation of the cumulative returns for the Norwegian and Swedish risk arbitrage portfolios, compared to their respective market returns. Figure 3 presents the same visualization for the Danish and Finnish risk arbitrage portfolios. When inspecting the Swedish graph in Figure 2, one can clearly see a large peak in returns during 2015. In the spring of 2015, Project Bidco Panther acquired the Swedish music company Aspiro. The offer price was SEK 1.05; however, the market did not react as expected. The share price went up 938% to SEK 11 on the 31st of March, only to rapidly fall back to the bid price. The reason for the extreme price appreciation was probably investors unaware of the bid pressing the price upwards (Nordenstam 2015).

Table 10 – Yearly country specific risk arbitrage portfolio returns

The table presents the value-weighted (VW), the equal-weighted (EW) and the practitioner arbitrage (PA) portfolios yearly returns for Norway (NOR), Sweden (SWE), Denmark (DEN) and Finland (FIN). For comparison, each country's main stock exchange is included. The period is from March 2007 to December 2016. CAGR is the Compound Annual Growth Rate.

Year	VW NOR	EW NOR	PA NOR	Oslo All-share	VW SWE	EW SWE	PA SWE	Stockholm All-share
2007	0.81%	-2.30%	3.57%	14.27%	-0.74%	-0.08%	2.82%	-4.12%
2008	-1.02%	3.26%	5.66%	-52.59%	-8.76%	-18.79%	-3.47%	-39.27%
2009	6.35%	3.65%	5.03%	55.47%	7.67%	5.50%	1.99%	52.24%
2010	15.43%	10.65%	2.98%	15.80%	20.96%	20.60%	2.86%	26.48%
2011	0.57%	2.61%	3.40%	-9.05%	-4.24%	-5.59%	1.49%	-13.71%
2012	9.06%	8.51%	2.75%	10.86%	3.90%	3.79%	2.29%	16.56%
2013	-2.13%	-3.55%	1.74%	22.89%	2.62%	0.99%	2.46%	27.77%
2014	-11.03%	-5.23%	0.41%	2.81%	16.23%	21.62%	3.92%	15.67%
2015	10.84%	14.23%	4.37%	4.71%	3.49%	2.93%	10.76%	10.19%
2016	-20.44%	-11.17%	-1.27%	12.19%	16.82%	17.91%	1.74%	6.60%
CAGR	0.31%	1.80%	2.84%	3.85%	5.40%	4.19%	2.64%	6.95%

Year	VW DEN	EW DEN	PA DEN	Copenhagen All-share	VW FIN	EW FIN	PA FIN	Helsinki All-share
2007	4.07%	4.07%	4.05%	4.41%	1.81%	6.40%	4.36%	20.44%
2008	15.67%	15.09%	6.65%	-47.96%	-16.16%	-14.88%	4.26%	-51.31%
2009	-1.08%	-1.08%	2.39%	35.47%	6.71%	4.58%	2.29%	26.21%
2010	2.21%	5.57%	1.50%	32.68%	-0.99%	-0.99%	0.64%	23.45%
2011	3.13%	29.88%	1.52%	-16.32%	-3.33%	-3.33%	1.04%	-27.02%
2012	0.12%	0.12%	0.46%	26.64%	3.04%	4.04%	1.07%	14.10%
2013	1.80%	0.93%	0.08%	30.65%	0.45%	0.45%	0.22%	32.24%
2014	-0.72%	-0.72%	0.02%	19.77%	4.00%	4.29%	0.69%	10.74%
2015	0.00%	0.00%	-0.51%	33.99%	-1.15%	-1.15%	-0.15%	14.86%
2016	-5.73%	-4.21%	-0.99%	-11.52%	40.53%	45.17%	14.56%	2.75%
CAGR	1.82%	4.56%	1.49%	6.74%	2.69%	3.55%	2.82%	2.78%

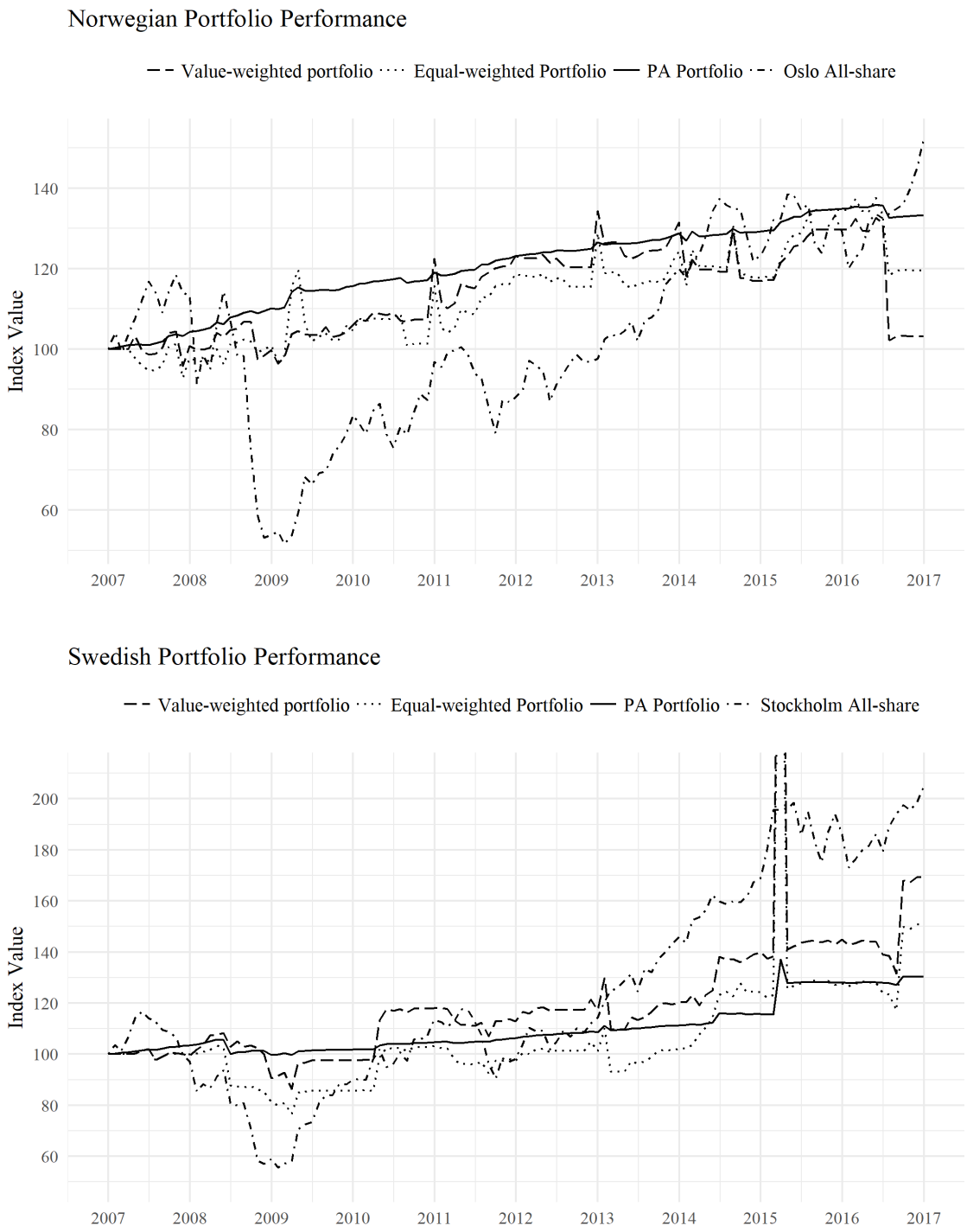

Figure 2 - Cumulative portfolio returns 2007-2016 – Norway and Sweden

The graph shows the performance of the Norwegian and Swedish value-weighted, equal-weighted and practitioner risk arbitrage portfolios compared to Oslo Stock Exchange All-share and OMX Stockholm Stock exchange All-share. The period is from 2007 to 2016. All four portfolios start at the same base level of 100.

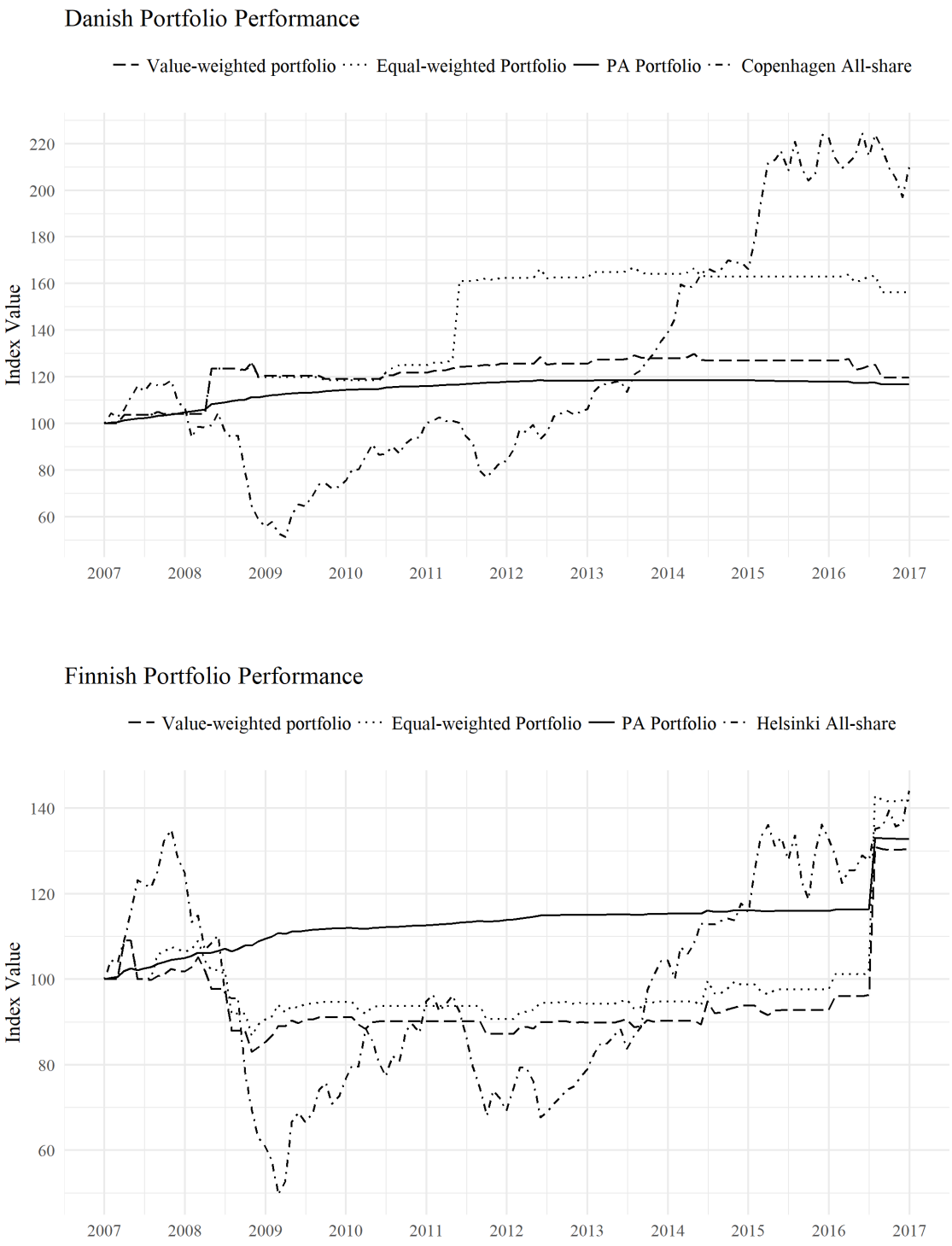

Figure 3 - Cumulative portfolio returns 2007-2016 – Denmark and Finland

The graph shows the performance of the Danish and Finnish value-weighted, equal-weighted and practitioner risk arbitrage portfolios compared to OMX Copenhagen Stock Exchange All-share and OMX Helsinki Stock exchange All-share. The period is from 2007 to 2016. All four portfolios start at the same base level of 100.

4.3.2 Country specific Capital Asset Pricing Model (CAPM)

First, it is important to note that the results are limited because of the limited number of transactions. Especially the Finnish and Danish portfolios have few observations; the Finnish data consists of only 17 transactions in the whole period. The Norwegian and Swedish data have a larger number of transactions, but few statistically significant results in the models. Second, the regressions are performed in comparison to the combined Nordic portfolios; each country's portfolios are regressed on their respective all-share market index. The results are presented in Table 11. Of the 12 regressions, only the Danish practitioner arbitrage portfolio shows excess returns statistically different from zero, about 0.04% monthly (statistically significant at a 10%-level). As noted earlier, the Danish PA portfolio consist of the Danish

Table 11 – Country specific CAPM results

The table presents the CAPM results for the value-weighted (VW), equal-weighted (EW) and practitioner arbitrage (PA) portfolios for each Nordic country. The respective country risk arbitrage portfolios are regressed on their all-share stock exchange returns minus the country specific risk free rate. NOR is the Oslo Stock Exchange, SWE is the OMX Stockholm Stock Exchange, DEN is the OMX Copenhagen Stock Exchange and FIN is the OMX Helsinki Stock Exchange. All the markets are total return (TR) all-share indices. Standard error in parenthesis.

	Norway			Sweden			Denmark			Finland		
	VW	EW	PA	VW	EW	PA	VW	EW	PA	VW	EW	PA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
α	-0.061	-0.000	0.027	1.393	1.259	0.103	0.076	0.334	0.036*	0.177	0.260	0.149
	(0.306)	(0.361)	(0.056)	(1.768)	(1.767)	(0.184)	(0.183)	(0.293)	(0.020)	(0.358)	(0.396)	(0.125)
β_M NOR	0.099*	0.057	0.016									
	(0.053)	(0.062)	(0.010)									
β_M SWE				0.115	0.174	0.038						
				(0.340)	(0.340)	(0.035)						
β_M DEN							0.007	-0.003	-0.001			
							(0.034)	(0.055)	(0.004)			
β_M FIN										0.067	0.072	0.018
										(0.061)	(0.068)	(0.021)
N	117	117	117	117	117	117	117	117	117	117	117	117
R^2	0.030	0.007	0.023	0.001	0.002	0.010	0.0004	0.00002	0.0003	0.010	0.010	0.006

Notes:

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

risk free rate in over half of the 117 months in the period, so it is not surprising that it generates risk-adjusted excess returns. It is, however, not a good indication of excess returns in Danish risk arbitrage generally, because of the very limited data. The Norwegian value-weighted portfolio is the only portfolio with a statistically significant beta coefficient (0.1 at a 10%-level). The low observed beta indicates that the portfolio is market-neutral.

The R-squared values are low, with a range from practically zero for the Danish data to 0.03 for the Norwegian value-weighted portfolio.

4.3.3 Country specific Fama-French Three-factor model

In total, 12 regressions are performed, regressing the value-weighted, equal-weighted and practitioner arbitrage portfolios on the European market premium, SMB and HML-factors. The European risk free rate is subtracted from all portfolios. The results are depicted in Table 12. It is important to note that the European factors and market premium include a much broader market than what the CAPM regressions did; the combined European market returns are comprised of 15 different European markets. The country specific CAPM and Fama-French Three-factor results are thus not directly comparable.

Both the Norwegian and Danish practitioner arbitrage portfolios have statistically significant excess returns of about 0.19% and 0.08%, respectively (statistically significant at a 1% level). The Norwegian PA portfolio also has a statistically significant beta of 0.02. It is only statistically significant on a 10% level, but because of the near-zero value, it indicates that the Norwegian PA portfolio is market-neutral in terms of risk. The PA portfolios are expected to have the lowest beta-value since they include portions of the risk-free rate.

Of the other regressions, only the Norwegian value-weighted portfolio has a statistically significant market beta (0.15), but no statistically significant excess returns. The beta is statistically significant on a 1% level, but the low value indicate that the portfolio is close to market neutral in economic terms.

The portfolios are largely insensitive to the size-factor SMB, with only three of twelve portfolios showing statistically significant coefficients. The Danish PA portfolio have an SMB value of about -0.02 (at the 10% level). A negative or close to zero SMB-factor typically indicates that the portfolio is slightly loaded towards less risky large-cap stocks. The value-

weighted and equal-weighted Finnish portfolios show SMB values of 0.38 and 0.35 at the 5% and 10% level, respectively. The positive values may indicate that the portfolios are loaded towards more risky small and mid-cap stocks. When looking at the composition of the portfolios in Table 4, the Danish targets have an average market value of EUR 489m and a median of EUR 78m. The average size is substantially higher than the Finnish average target market value of EUR 208m (EUR 144.6m median). Although the loading towards small or large-cap might be reasonable when comparing the two countries' portfolios to each other, the Danish PA portfolio mostly consists of the risk free rate. In addition, Fama-French factor loading should be viewed in a European context. The few active transactions in the Danish and Finnish data may ultimately bias the result, so in economic terms the results do not hold much value. If the results had been the same for the Norwegian and Swedish portfolios, which have a much larger number of active transactions, the results might have been more conclusive.

Having presented the results from my empirical analysis, in the next section I will summarize my findings on Nordic risk arbitrage and present my conclusions.

Table 12 – Country specific Fama-French Three-factor results

The table depicts the Norwegian (NOR), Swedish (SWE), Danish (DEN) and Finnish (FIN) value-weighted (VW), equal-weighted (EW) and practitioner arbitrage (PA) portfolios regressed on the European market premium and Fama-French factors SMB and HML. The dependent portfolios are subtracted the European risk-free rate. Standard error in parenthesis.

	VW NOR	EW NOR	PA NOR	VW SWE	EW SWE	PA SWE	VW DEN	EW DEN	PA DEN	VW FIN	EW FIN	PA FIN
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
α	-0.028	0.132	0.185***	1.662	1.566	0.202	0.116	0.357	0.078***	0.169	0.250	0.184
	(0.346)	(0.365)	(0.058)	(1.780)	(1.780)	(0.186)	(0.184)	(0.294)	(0.023)	(0.353)	(0.393)	(0.126)
β_M EU	0.152**	0.107	0.019*	-0.216	-0.186	-0.010	0.012	0.013	-0.003	0.107	0.110	0.017
	(0.068)	(0.072)	(0.011)	(0.352)	(0.352)	(0.037)	(0.036)	(0.058)	(0.004)	(0.070)	(0.078)	(0.025)
SMB	0.142	0.072	-0.011	-0.302	-0.427	-0.057	-0.106	-0.115	-0.019*	0.377**	0.346*	0.064
	(0.174)	(0.183)	(0.029)	(0.894)	(0.894)	(0.093)	(0.092)	(0.148)	(0.011)	(0.177)	(0.198)	(0.063)
HML	-0.225	-0.114	-0.027	0.413	0.410	0.030	-0.062	-0.129	-0.009	-0.143	-0.169	-0.024
	(0.166)	(0.175)	(0.028)	(0.856)	(0.856)	(0.089)	(0.088)	(0.141)	(0.011)	(0.170)	(0.189)	(0.061)
N	117	117	117	117	117	117	117	117	117	117	117	117
R^2	0.047	0.020	0.025	0.005	0.005	0.004	0.015	0.013	0.039	0.056	0.043	0.013

Notes:

***Significant at the 1 percent level.

**Significant at the 5 percent level.

*Significant at the 10 percent level.

5. Conclusion

The objective of this study was to examine the existence of excess returns in a risk arbitrage investment strategy executed in the Nordic market. I have constructed three differently weighted portfolios and conducted linear regressions analysis using three different models on a sample of 182 cash transactions from March 2007 to November 2016. I have benchmarked the portfolios on both Nordic and European market returns, and the results between them differ. In addition, I have partitioned the transactions by country to investigate national differences.

In terms of absolute return, the Nordic risk arbitrage portfolios have annual returns of 4.8% to 11.6%. Only the practitioner arbitrage portfolio do not outperform the Nordic market benchmark in the period. All Nordic risk arbitrage portfolios outperform the European benchmark in the period. The Swedish transactions are the most profitable, with returns of 2.6% - 5.4% annually. The Norwegian returns are the least profitable with returns ranging from 0.31% - 2.84% annually.

I would like to emphasize that the regression results with a Nordic market benchmark should outweigh the results with a European market benchmark. When looking at the market benchmark returns, the Nordic had an annual return of 6.33%, while the European only had annual returns of 0.44%. The Nordic benchmark consistently produce statistically significant market betas of between 0.106 – 0.115 for the value-weighted risk arbitrage portfolio, 0.15 for the equal-weighted portfolio and between 0.05 – 0.062 for the practitioner arbitrage portfolio. The European market returns only show statistically significant correlation for the value-weighted portfolio (beta of 0.1). The low correlation between the risk arbitrage portfolios and the Nordic market confirms that the risk arbitrage investment strategy have little systematic risk, and is near independent of market variations. The lack of statistically significant correlation with the European market benchmark may simply indicate that the risk portfolios are in fact market neutral in terms of risk. Furthermore, similar to the results in Germany by McDermott and Mulcahy (2017), there are no portfolios sensitive to any of the additional factors (SMB, HML or liquidity).

Regarding the country specific portfolios, I find excess returns in the Norwegian and Danish practitioner arbitrage portfolios. However, these are regressed against the European market benchmark, meaning that they can only serve as an indication of, and not as evidence

for, excess returns. When comparing to a CAPM regression on the native markets, none of the portfolios show excess returns. Some of the Finnish and Danish data do show sensitivity towards the size-factor, but both countries' portfolios have few transactions and a high number of months with no active transactions. The Norwegian value-weighted portfolio have a Norwegian market beta of 0.1 (only statistically significant at the 10% level), showing low systematic risk. The Danish practitioner arbitrage portfolio have monthly excess returns of 0.04% (0.5% annually) on the Danish market and 0.08% (1% annually) on the European market. However, the data is not satisfying with only 25 transactions over a 10-year period, and 72 of 117 months with no transactions at all.

I find statistically significant risk arbitrage excess returns in all portfolios regressed on the European market benchmark. About 0.5% (6% annually) for the value-weighted, 0.9% - 1% (about 12% annually) for the equal-weighted and 0.34% (4% annually) for the practitioner arbitrage portfolio. When compared to the European market benchmark, a Nordic arbitrage investment strategy do produce excess returns. However, when keeping in mind that the Nordic market benchmark outperform the European market benchmark in absolute returns, the excess returns in Nordic risk arbitrage should be based on the Nordic market benchmark. With no statistically significant excess returns in any of the regressions on a Nordic market benchmark, there are no evidence to support the existence of excess returns in Nordic risk arbitrage. In other words, there are no abnormal returns for arbitrageurs in the Nordic market. It is important to note that the Norwegian factors I use might be too specific, and that the European factors are too broad. It is possible that an analysis with Nordic factors will yield a different result.

One explanation for the lack of excess returns may be the information efficiency in the Nordic markets. Of the 361 cash transactions in the initial sample, about 50% were excluded because the market price were higher or the same as the offer price one day after announcement. In the U.S., the same negative speculation spread is found in about 23% of the announced transactions (Jindra and Walkling 2004). The fact that the Nordic markets also exhibit the lowest premiums in Europe might diminish the opportunity for excess return (Moschier and Campa 2009).

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